Chief, Permits Division
Office of Protected Resources
National Marine Fisheries Service
Silver Spring, MD 20810-3226

**I. Application for a Permit for Scientific Research or to Enhance the Survival or Recovery of a Stock under the Endangered Species Act and the Marine Mammal Protection Act**

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**III. Applicant**

Dr. Randall W. Davis, Principal investigator
Department of Marine Biology
Texas A&M University
5007 Avenue U
Galveston, TX 77551
(409) 740-4712
Email: davisr@tamug.tamu.edu

Donald Calkins, Co-investigator
Alaska SeaLife Center
P.O. Box 1329
Seward, AK 99664
(907) 224-6325

This permit application describes activities to be conducted under two funded and related projects dealing with Steller sea lions (SSL). The first is a National Marine Fisheries Service (NMFS)-funded study of diving and hunting behavior that will involve attaching a small video system/data logger to SSL for up to a several weeks. The second project is funded by the Alaska SeaLife Center (ASLC) in Seward and will involve attaching satellite transmitters to SSL for up to one year. In some cases, the same animals may temporarily carry both instruments for the purpose of cross-comparison of diving and location data. R. Davis is the Principal Investigator for both of these studies. Donald Calkins of the ASLC is the Co-investigator for the latter project.

## PROJECT 1. Foraging Ecology and Hunting Behavior of Adult and Juvenile Steller Sea Lions
## PROJECT 2. Steller Sea Lion Critical Habitat Assessment

**IV.A. Abstract**: We propose to study the hunting behavior and three-dimensional movements of SSL by attaching a small video system/data recorder to free-ranging adults and juveniles. To characterize SSL habitat-associations, we will combine satellite tracking and dive data with bathymetry and TOPEX/POSEIDON and ERS satellite remote sensing of hydrographic features. The proposed work will provide

fundamental information on the foraging ecology of SSL and enable us to compare general foraging strategies, searching mechanics, modes of locomotion, and foraging efficiency of SSL at different rookeries, for different age classes, and at different times of the year. The results will address questions of prey preference, predator/prey relationships and ecological attributes of foraging habitat. In addition, we will assess the abundance, distribution, and composition of prey at spatial and temporal scales pertinent to foraging SSL. This study, which will be conducted in collaboration with NMFS, the Alaska Dept. of Fish and Game (ADFG) and the ASLC, will augment already funded investigations of diving behavior and provide a better understanding of the foraging ecology and hunting behavior of juvenile and adult female SSL. For a detailed discussion of the objectives and hypotheses to be tested, please see pp 3-10 of the attached proposal for Project 1 and pp 1-3 for Project 2.

**IV.B. Summary of Marine Mammals to be Taken, Imported, or Exported**

**B1 Species Name:** Steller sea lions (*Eumetopias jubatus*); western (endangered) population. No other protected species will be taken incidentally during the course of our activities.

**B2. Parts or specimen samples:** We will take blood samples (20 ml), tissue samples (skin sample with a flipper punch and blubber 0.5 g) and rectal, vaginal, ocular and dermal lesion swabs from each animal one time (see Table 1). We do not plan to kill or euthanize any animals. However, if an animal dies accidentally during sedation, we will take samples of all organs and tissues back to Texas A&M University. These samples will be used on our on going studies of marine mammal morphological and metabolic adaptations for diving and hypoxia.

**B3. Status of the affected species.** A series of surveys conducted in the late 1950s and mid-1960s estimated the total population of SSL at 240,000 to 300,000 individuals (Hoover, 1988). Over the past 30 years, the population has declined by more than 80% (to ca. 60,000 animals), resulting in the species being listed as threatened under the United States Endangered Species Act in 1990 (U.S. Fed. Reg. 55:49204). The decline of SSL has not been uniform throughout their range; SSL populations in southeast Alaska, British Columbia and Oregon have remained relatively stable, with the greatest declines occurring in the Aleutian Islands and western Gulf of Alaska, which historically had the largest fraction of the worldwide population (York et al., 1996). In 1997, Alaskan SSL were classified as endangered (U.S. Fed. Reg. 62:24345) in the western part of their range, and continue to be listed as threatened in the eastern region.

A number of possible causes for the decline have been proposed, including redistribution, pollution, predation, subsistence and commercial harvesting, disease, natural fluctuations, environmental changes and commercial fishing (Alaska Sea Grant, 1993). A change in the overall distribution and abundance of key prey species is suspected to be the most significant factor influencing the current population declines. SSLs feed nearshore and over the continental shelf, at relatively shallow depths (usually 50 m or less) (Merrick and Loughlin, 1997). In Alaska, their principal prey include walleye pollock, Pacific cod, Atka mackerel, octopus, squid, herring, flatfishes and

sculpins (Pitcher 1981; Merrick et al., 1997). There are seasonal as well as geographic shifts in the diet that may reflect changes in the distribution of prey (Merrick et al., 1997; Norcross, 1999). A shortage of food could cause reproductive failure either during gestation or during lactation if a female is unable to obtain sufficient energy to maintain the pregnancy or for milk production. While adult animals can range extensively in search of food during the non-breeding season, lactating females are limited in both the time and distance they can range from the rookeries during their foraging trips because of the need to return to suckle their pup. Females may travel as far as 300 km from haul-out sites during non-breeding season, while females with pups generally feed within 20 km of their rookery (Merrick et al., 1994). In addition, weaned pups cannot dive as deeply or for as long as adults (Sandegren, 1970), and this may further limit the types of prey available to them, making maternal investment during lactation and size at weaning critical to their survival.

## IV.C. DESCRIPTION OF THE PROPOSED ACTIVITIES

**C1. Duration of the Project and Locations of Taking:** Research will be conducted in the Gulf of Alaska and Aleutian Islands from February 2002 to January 2007. Funding has been obtained for the first three years, but continued funding for the fourth and fifth years is expected. Dates and locations of taking will depend on research cruises organized by the NMFS, ADFG and ASLC. These organizations will be providing logistical support, but their takes will be separate from those requested in this application. Sites currently being considered include Kayak Island (GOA), Fish Island (PWS), Chirikof Island (GOA), Yunaska Island (AI) and Seguam Island (AI). Cruises may occur throughout the year (i.e., during all four seasons).

**C2. Types of Taking** (See Table 1 for the numbers of animals, sizes of samples and frequency of sample collection).

**1. Capture and Restraint**: We will capture 45 SSL per year for five years using underwater lasso or darting with Telazol (see Table 1). Adult animals will be females, which may be pregnant. Juvenile animals may be either sex. A veterinarian (to be identified; qualifications will be submitted to the Office of Protected Species before field work commences) will anesthetize animals for up to three hours using gas anesthesia. This is the estimated maximum time needed for intubations for gas anesthesia, weighing, taking morphometric measurements, branding, taking blood and tissue samples, and attaching satellite telemeters and/or video/data recorders.

General Effects of Capture and Restraint: Restraint procedures constitute one of the most stressful incidents in the life of an animal, and intense or prolonged stimulation can induce detrimental responses. Each restraint incident has some effect on the behavior, life, or activities of an animal. A variety of somatic, psychological, and behavioral stressors can be associated with capture and restraint of wild animals. These include strange sounds, sights, and odors, the effects of chemicals or drugs, apprehension

TABLE 1. Total Take Table

| Task # | Activities | Age Class | | # Takes Per animal |
|---|---|---|---|---|
| | | **Adults** | **Juveniles and pups** | |
| a. | Capture using different methods including underwater lasso and darting with Telazol. Animals will be anesthetized for up to three hours using gas anesthesia. While anesthetized, animals will be weighed, measured, flipper tagged, hot branded, blood sampled (20 ml) and tissue sampled: skin sample with a flipper punch; blubber (0.5 g); rectal, vaginal, ocular and dermal lesion swabs one time.<br><br>Attach video system/data logger, GPS and transmitters (satellite, VHF radio and acoustic).<br><br>Recapture up to three times to attach and remove instruments. | 75 (females; may be pregnant) | 150 juveniles only (males and females) | 3 |
| b. | Incidental harassment during research activities | 1000 (males and females) | 1000 juveniles and pups (males and females) | |
| c. | Accidental mortality | 15 | 25 juveniles<br>25 pups | |
| d. | Incidental harassment of other | 0 | 0 | |
| e. | Import samples | 0 | | |

(which may intensify to become anxiety, fright, or terror), and territorial or hierarchical upsets associated with displacement of animals by researchers who come onto rookeries and haulouts. Animals that are stressed can incur contusions, concussions, lacerations, nerve injuries, hematomas, and fractures in their attempts to avoid capture or escape restraint. The stress response can change an animal's reaction to many drugs, including those commonly used for chemical restraint, which can have lethal consequences. Continuous stimulation of the adrenal cortex, as from stress associated with chronic disturbance or repeated capture, can cause muscle weakness, weight loss,

increased susceptibility to bacterial infections, and poor wound healing, and can lead to behavioral changes including increased aggressive and antisocial tendencies. Capture myopathy is a possible consequence of the stress associated with chase, capture, and handling in numerous mammal species. Capture myopathy is characterized by degeneration and necrosis of striated and cardiac muscles and usually develops within 7 to 14 days after capture and handling. It has been observed both in animals that exert themselves maximally and those that remain relatively quiet, and occurs with either physical or chemical restraint. Fear, anxiety, overexertion, repeated handling, and constant muscle tensions such as may occur in protracted alarm reaction are among the factors that predispose an animal to this disease. A variety of factors may function in concert or individually. The muscle necrosis is likely due to acidemia resulting from a build up of lactic acid following profound muscle exertion: once necrosis has occurred, the prognosis for recovery is not favorable. The number of times an animal is captured, the method(s) of restraint, as well as the age and general condition of the animal are all factors that will affect an animal's response to capture.

Effects of Chemical Immobilization (Anesthesia/Sedation): A fairly high mortality rate caused by anesthesia has been reported in otariids. Delivery of anesthesia in pinnipeds can be complicated by their particular anatomical and physiological specializations to the marine environment and by the logistics of working with wild animals. Determining the proper dose is dependent on a fairly accurate assessment of the animal's weight and condition, as miscalculation of an animal's weight can lead to an overdose, which can have lethal consequences. For this reason, it is important that the chemical used have a rapid reversal agent that can be administered should the animal show signs of distress or adverse reaction. The typical induction time for most chemical restraint agents is 10 to 20 minutes following intramuscular injection. Thus, darting can be dangerous because it can spook an animal into the water before the immobilization has taken affect, which can result in drowning. The safest injection site for projectile syringes (darts) are in the deep muscle areas of the hind limbs. However, the blubber layer on pinnipeds can make delivery of an injectable drug into the muscle, where needed for proper absorption and distribution, difficult. In addition, inadvertent injection of drugs into the blubber frequently results in aseptic necrosis, sometimes leading to large abscesses. Injections into the chest cavity or stomach region can result in puncture of the lungs or stomach, which may kill the animal. Hyperthermia (over-heating) can occur in animals under anesthesia because the blubber layer can make heat dissipation a problem, even at ambient temperatures that are comfortable for the researchers: otariids over 25 kg tend to become hyperthermic during anesthesia. Hypothermia can also occur in sedated animals, during anesthesia or post-recovery, as many drugs can affect thermoregulation. In hypothermia, the reduction in body temperature reduces tissue metabolism, while hyperthermia increases it. Both of these can have implications for the animal's reaction to any drugs administered, as well as any pathological conditions that may exist. About 10% of animals induced with Telazol (tiletamine-zolazepam) or gas were observed to become apneic (stop breathing) within five minutes of induction. Tiletamine is a cyclohexamine, which is a dissociative anesthetic that induces catatonia. It also has an analgesic effect through its action on the spinal cord, but it does not block visceral pain. Both hyperthermia and hypothermia are possible consequences of immobilization with tiletamine, depending on ambient

temperatures. Respiratory depression is also possible, as is hypersalivation, which can lead to choking or aspiration of fluid. There is an excitatory phase seen with tiletamine characterized by occasional muscle spasms resembling seizures, due to spinal reflex firings, which can be minimized by using tiletamine in combination with diazepam. Zolazepam is a benzodiazepine, or antianxiety drug, that has a sedative effect and is a skeletal muscle relaxant. Zolazepam slightly depresses cardiovascular function. Both tiletamine and zolazepam are excreted in the kidneys and are contraindicated in animals with severe renal or hepatic disease. The safety of these drugs is adversely affected in animals that are ill, stressed, or which have suffered from physical exertion (e.g. have been chased) prior to administration of the drug. There is no antidote (reversal agent) for tiletamine. Diazepam, which is a benzodiazepine similar to zolazepam, is metabolized slowly, with clinical effects typically disappearing within 60 to 90 minutes. There is a reversal agent for zolazepam, flumazenil. However, because zolazepam is used in combination with tiletamine to reduce the effects of the excitatory phase, reversing the effects of zolazepam in the absence of a reversal agent for tiletamine could result in convulsions and other side effects. Inhalation anesthetics such as isoflurane gas are used to induce anesthesia in animals that can be manually restrained, and are commonly used to augment analgesia or increase the depth of anesthesia in animals previously immobilized by injectable agents. Prolonging immobilization by administering repeated doses of injectable agents is associated with a high risk of mortality, and an additional dose of Telazol should never be given. Isoflurane, a halogenated ether with potent anesthetic action, is an inhaled general anesthetic that induces reversible depression of the central nervous system, resulting in unconsciousness, analgesia, voluntary muscular relaxation, and suppression of reflex activity. Isoflurane is especially useful for short procedures in which rapid recovery and few aftereffects are desirable. The effects of inhalation anesthetics increase predictably with increased dose, unlike injectable agents, which tend to be unpredictable and idiosyncratic among animals. In general, captive animals have been observed to fully recover from anesthesia with isoflurane after 8 hours. Note that is not possible to distinguish movement due to pain from that caused by drug-induced central nervous system stimulation. General anesthesia is not an all-or-nothing phenomenon, thus the extent to which the central nervous system must be depressed to diminish the response to a certain painful or noxious stimulus depends on the stimulus, where it is applied anatomically, and, to some extent, the individual to which it is applied.

Effects of capture by underwater lasso: We will capture juveniles in the water using the lasso technique developed by the Alaska Department of Fish and Game. Two or three divers, supported by a skiff and a larger vessel, approach a haulout under water. The natural curiosity of young sea lions draws them to the divers. After a brief period of accustomization, sea lions will approach close enough that a rope lasso tended by personnel in the skiff can be placed around them, slightly behind the fore flippers, by the divers. The lasso is tightened and the rope is retrieved by the skiff crew. Animals are wrapped in a restraining net and pulled into the skiff and restrained by hand. This technique has proven to be effective and safe for divers and captured animals. The greatest danger to animals is accidental drowning once the lasso is around them. Only NMFS and ADFG personnel with experience using this capture technique will be used.

Mitigation: To minimize the effects of handling adult and subadult SSL, we will use veterinarians and experienced biologists to watch for signs of distress, and release animals showing such signs. To avoid respiratory distress, ischemia (restricted blood flow), or nerve damage, animal's will be properly positioned, i.e. ventrally recumbant, during anesthesia. It is important to avoid prolonged breath holding during gas anesthesia as this can result in cardiac hypoxia (lack of oxygen to the heart muscle): therefore, respiration and blood oxygen saturation will be monitored and oxygen administered as needed. Veterinarians will be prepared to control or assist ventilations when using valium, isoflurane, or tiletamine. The animal's body temperature will be closely monitored and steps taken to avoid hypo- and hyperthermia (e.g. cooling with water or covering to keep warm, as necessary). In addition, any animal showing signs of distress while being handled will be released immediately and closely monitored. To mitigate the effects of capture and handling, the attending veterinarian(s) will be present during all procedures for this study to monitor the physiologic state of each animal (e.g., by monitoring respiratory rate and character, heart rate, body temperature, and behavioral response to handling and sampling procedures). An emergency kit with equipment and supplies for responding to complications or emergencies will be readily available. Drug doses will be calculated on the basis of an animal's lean body mass, and metabolic rate. To reduce the risk of unintentional injection of drugs by projectile syringe (darts) into blubber, intravenously, or into vital organs, the length of the needle used will be appropriate for the size of the animal and it's blubber thickness. In addition, care will be taken in darting animals so as to avoid accidental drownings of animals that either flee into the water prior to induction or slump into pools of water at induction. There is a risk of accidental death during capture and anesthesia. In addition, some animals could die during disturbance of the rookery, capture and handling and infection from blood and tissue sampling (see below). We request that up to three (3) adult, five (5) juveniles and five (5) pups per year can die accidentally during research activities on the rookeries for a total of 65 animals over a five year period (see Table 1). We will focus our research on juveniles and adult females. We will not be studying pups, but accidental death could result from disturbance of the rookeries. 400 sea lions per year for five years (2,000 total) may be disturbed during research activities involving the capture, attachment and recovery of instruments. We estimate that half of these animals may be adult males and females and half juveniles and pups (Table 1). We will minimize disturbance to the rookery by working around the margins and avoid going into dense aggregations of animals.

**2. Blood collection (venipuncture)**

We will collect blood samples from all animals captured for routine health assessment based on standard hematology and blood chemistry. This is in accordance with the final Recovery Plan for SSL, which identified the need to monitor the health, condition, and vital parameters of sea lions (research task 4). More specifically, this included developing indices of condition (research task 432) and obtaining measurements and samples using non-lethal techniques (research task 445). The Recovery Plan also

called for research to determine if biological parameters indicate different stocks of sea lions (research task 22).

This procedure will be performed in conjunction with capture, gas anesthesia, flipper tagging, hot branding and tissue collection. The most common site for blood collection in SSL is the caudal gluteal vein, which is near the animal's tail, just to the side of the spine. To locate a vein, the animal must be restrained symmetrically, lying on it's stomach with foreflippers tucked against the body and hindflippers straight out behind the animal. The caudal gluteal vein is not particularly large, especially in young pups, and can be difficult to locate beneath the fur, especially if the animal is not properly restrained and immobilized.

Effects: The effects of this procedure are largely related to the risks of capture and restraint are described above. There is a small risk of infection associated with penetration of the animal's dermis by the needle. Additionally, multiple attempts to obtain a blood sample are not only stressful and cause some degree of pain, they can result in damage to the vein, clotting, and abscess. Removing a volume of blood too large relative to the animal's mass and ability to replace what was taken can result in fatigue, anemia, weakened immunity, and problems with clotting.

Mitigation: To reduce the risk of infection, only clean, sterile disposable needles will be used to obtain blood samples and a new needle will be used for each blood collection. Needles will not be re-used on individual animals or between animals. The area to be sampled will be thoroughly disinfected with ethyl alcohol or betadine prior to insertion of the needle. Only qualified veterinarians or other personnel with sufficient experience in the technique will be allowed to perform this procedure. The animal will be anesthetized with isoflurane and respiration will be closely monitored. The attending veterinarian(s) will be present during all procedures for this study to monitor the physiologic state of each animal (e.g., by monitoring respiratory rate and character, heart rate, body temperature, and behavioral response to handling and sampling procedures). An emergency kit with equipment and supplies for responding to complications or emergencies should be readily available. The volume of blood taken from individual animals will not exceed 10 ml blood per kg body mass.

**3. Flipper tagging:** Any animal captured will be marked with plastic cattle ear tags for future identification. These tags will be affixed through a foreflipper in loose skin anteriorly, near the area where the flipper meets the body. The hole is made with a punch. Each animal receives two tags, one per flipper, to minimize the chance of losing the ability to identify the animal should one tag be lost. This procedure will be performed in conjunction with capture, gas anesthesia, hot branding and blood and tissue collection.

Effects: The effects of this procedure are largely related to the risks of capture and restraint are described above. These types of tags are best considered semipermanent markers as they can and do pull out because sea lions use their foreflippers in both aquatic and terrestrial locomotion. In addition to the effects of capture and restraint as described above, it is likely that affixing these tags to the flippers of sea lions causes

more than momentary pain. When the tag is affixed there is the potential for infection at the wound site, particularly because the environment on the rookery is not aseptic and because the activity of the animal may prolong or prevent healing by producing repetitive stress on the wound. There is also the potential for infection when a tag pulls out of the flipper, for whatever reason. In moving about on a rookery or haulout, or swimming, there is the potential for a tag to be torn out of the flipper by abrasion on the substrate or by hydrodynamic pressure. There is no quantitative information on the rate of infection caused by flipper tagging Steller sea lions. Flipper tags can become difficult to read as the colors and markings on them fade over time and that they are not readily visible from any distance, partially because the gregarious nature of sea lions causes them to group together and obscure the flippers.

Mitigation: Care will be taken to avoid placing the tag so low as to have the animal walking on it or so high as to have it irritating the animal's flank area. To reduce the risk of infection, the area will be thoroughly disinfected with ethyl alcohol or betadine prior to applying the tag. In addition, the tags will be thoroughly cleaned and disinfected immediately prior to application. Only qualified veterinarians or other personnel with sufficient experience in the technique will be allowed to perform this procedure. The animal will be anesthetized with isoflurane and respiration will be closely monitored. The attending veterinarian(s) will be present during all procedures for this study to monitor the physiologic state of each animal (e.g., by monitoring respiratory rate and character, heart rate, body temperature, and behavioral response to handling and sampling procedures). Only animals believed to be in optimal health will be captured and subjected to this and other invasive procedures. The piece of skin removed by the punch will be preserved and used for future genetic analysis.

**4. Hot branding:** Any animal captured will be marked by hot branding for future identification. Although not an essential part of our research, we concur with NMFS that once an animal is captured and you have its vital statistics (e.g., sex, location, blood variables, health status), it is of scientific interest to be able to identify it again. Hot brands place permanent, unique numbers and/or letters on the animal's right and left flanks to improve the ability to identify the animal. This procedure would be performed in conjunction with capture, gas anesthesia, flipper tagging and blood and tissue collection.

Effects: The effects of this procedure are largely related to the risks of capture and restraint are described above. Compared to flipper tags, hot branding is a permanent marker that is not susceptible to tag loss. In addition to the effects of capture and restraint as described above, it is likely that hot branding causes more than momentary pain. Hot branding is conducted on anesthetized animals to minimize pain. The animal will be anesthetized with isoflurane and respiration will be closely monitored. The attending veterinarian(s) will be present during all procedures for this study to monitor the physiologic state of each animal (e.g., by monitoring respiratory rate and character, heart rate, body temperature, and behavioral response to handling and sampling procedures). There is the potential for infection at the wound site, particularly because the environment on the rookery is not aseptic and because the activity of the animal

may prolong or prevent healing by producing repetitive stress on the wound. There is no quantitative information on the rate of infection caused by hot branding Steller sea lions.

Mitigation: Only qualified veterinarians or other personnel with sufficient experience in the technique will be allowed to perform this procedure. The animal will be anesthetized with isoflurane and respiration will be closely monitored. The attending veterinarian(s) will be present during all procedures for this study to monitor the physiologic state of each animal (e.g., by monitoring respiratory rate and character, heart rate, body temperature, and behavioral response to handling and sampling procedures). Only animals believed to be in optimal health will be captured and subjected to this and other invasive procedures.

**5. Rectal, vaginal, ocular and dermal lesion swabs:** This procedure will be performed in conjunction with capture, gas anesthesia, flipper tagging and blood and tissue collection.

Effects: The effects of this procedure are largely related to the risks of capture and restraint are described above. There is a very small risk of infection associated with swabbing the animal's dermis, rectum, and ocular area.

Mitigation: The animal will be anesthetized with isoflurane and respiration will be closely monitored. The attending veterinarian(s) will be present during all procedures for this study to monitor the physiologic state of each animal (e.g., by monitoring respiratory rate and character, heart rate, body temperature, and behavioral response to handling and sampling procedures). To reduce the risk of infection, only clean, sterile disposable swabs will be used. Only qualified veterinarians or other personnel with sufficient experience in the technique will be allowed to perform this procedure. .

**6. Blubber biopsy:** We will collect a blubber biopsy (up to 0.5 g) from all animals captured for future fatty acid analysis and toxicological analysis. This procedure will be performed in conjunction with capture, gas anesthesia, flipper tagging and blood collection. The most common site for blubber biopsy in Steller sea lions is at the base of the neck.

Effects: The effects of this procedure are largely related to the risks of capture and restraint are described above. There is a small risk of infection associated with penetration of the animal's dermis with a scalpel to obtain a small piece (ca. 0.5 g) of subcutaneous blubber.

Mitigation: The animal will be anesthetized with isoflurane and respiration will be closely monitored. The attending veterinarian(s) will be present during all procedures for this study to monitor the physiologic state of each animal (e.g., by monitoring respiratory rate and character, heart rate, body temperature, and behavioral response to handling and sampling procedures). To reduce the risk of infection, only clean, sterile disposable scalpel blades will be used to obtain biopsy samples and a new scalpel blade will be

used for each biopsy. Scalpel blades will not be re-used on individual animals or between animals. The area to be sampled will be thoroughly disinfected with ethyl alcohol or betadine prior to insertion of the scalpel. After the biopsy is taken, the wound (about 2 cm wide) will be sutured closed. Only qualified veterinarians or other personnel with sufficient experience in the technique will be allowed to perform this procedure.

**7. Attaching instruments:** We will attach the video/data recorder and/or satellite telemeters to all animals captured. This procedure will be performed in conjunction with capture, gas anesthesia, flipper tagging, hot branding and blood and tissue collection.

Effects and Mitigation: The effects of this procedure are largely related to the risks of capture and restraint are described above. The animal will be anesthetized with isoflurane and respiration will be closely monitored. The attending veterinarian(s) will be present during all procedures for this study to monitor the physiologic state of each animal (e.g., by monitoring respiratory rate and character, heart rate, body temperature, and behavioral response to handling and sampling procedures). A video system/data logger, GPS and transmitters (satellite and VHF) will be attached to the fur with epoxy or neoprene rubber cement (total area is ca. 0.002 square meters). After cleaning the fur in the mid-dorsal area of the sea lion with acetone, a remote release pack with the video/data recorder (see pp 10-14 of the attached proposal for Project 1 for a detailed description of the instrumentation) will be glued with epoxy or neoprene rubber cement to the fur along the dorsal midline above the shoulders. The acetone and volatile components of the neoprene cement may be absorbed into the skin. We use a slow-setting epoxy, so there is little chance of burning the skin. Since the acetone is applied to a sponge to clean the fur, little comes into contact with the skin and no adverse reactions are expected. Likewise, only small amounts of epoxy and neoprene rubber cement are applied to the fur. Based on our experience with attaching the video/data recorder to Weddell seals, no adverse reactions have been observed from the epoxy or neoprene rubber cement. A smaller remote release system will be glued to the top of the animal's head. The combination camera head/GPS housing rests in the second release pack mounted on the head. Based on our experience with Weddell seals, the animals ignore the instruments and do not attempt to bite or rub them off, and they usually begin foraging within one day. Once mounted on the animal, the entire video system/data recorder is neutrally buoyant in water and weighs about 2 kg in air (about 1% of the mass of a juvenile and 0.7% if the mass of an adult female SSL). The instrument will augment hydrodynamic drag, but the cross sectional area of the instrument will be less than 2% of the maximum cross sectional area of the animal, so drag augmentation will not be large. Again, based on our experience with Weddell seals, the video/data recorder does not appear to diminish foraging and prey capture. The dual release system can be remotely triggered to allow the video system/data recorder to fall off. The low-profile, remote release pack eventually falls off when the sea lion molts three to six months later. We will use satellite transmitters (Wildlife Computers, 200 g) and VHF radio transmitters (165 MHz; 92 g; Advanced Telemetry Systems) to track and relocate instrumented animals. These transmitters will be glued with epoxy or neoprene rubber cement to the sea lion's fur. The video system will

remain on the animal for up to two weeks before triggering the release. The transmitters will fall off when the animal molts three to six months later.

Animals may be recaptured up to three times to attach and remove instruments to replace batteries and videotape in the video/data recorders. During recapture, animals with video/data recorder will be anesthetized for less than one hour. The attending veterinarian(s) will be present during all procedures for this study to monitor the physiologic state of each animal (e.g., by monitoring respiratory rate and character, heart rate, body temperature, and behavioral response to handling and sampling procedures). No recapture will be required for animals instrumented with VHF and satellite telemeters only. The numbers of animals that can be reasonably captured and the cost of instruments limit our sample size. Based on research with other species such as Weddell seals (Davis et al., 1999), the proposed sample size will provide fundamental information on the foraging ecology of SSL and enable us to statistically compare general foraging strategies, searching mechanics, modes of locomotion, and foraging efficiency of SSL at different rookeries, for different age classes, and at different times of the year. The results will address questions of prey preference, predator/prey relationships and ecological attributes of foraging habitat. In addition, we will assess the abundance, distribution, and composition of prey at spatial and temporal scales pertinent to foraging SSL using video recorded prey captures (see pp 3-10 of the attached proposal for Project 1and pp 1-3 for Project 2 for details of the research objectives and hypotheses to be tested and methods).

This study will be conducted in collaboration with NMFS, the ADFG and the ASLC, who will be providing logistical support in the field (e.g., ship support). Our research will augment already funded investigations of diving behavior and provide a better understanding of the foraging ecology and hunting behavior of juvenile and adult SSL. Due to the nature of these studies, they cannot be performed on other species. A surrogate species would provide little direct information on the at-sea behavior and habitat use of SSL. See pp 1-10 of the attached research proposal for Project 1 for a justification of the age classes to be studied.

**C3. Research in the Wild.** (See pp 3-18 in the attached proposal for Project 1 and pp 1-4 for Project 2 for a detailed description of the research objectives, hypotheses to be tested, and methods).

Adult and juvenile SSL will be chosen opportunistically based on their accessibility for capture (i.e., they are not likely to enter the water before the Telazol takes effect and are not near other animals that may interfere with the procedures of the animal itself). Adult females will be darted with Telezol (Tiletamine HCl and Zolazepam HCl, Fort Dodge Laboratories, Fort Dodge, Iowa 50501, USA: 2.0 mg per kg body mass), intubated and anesthetized with isoflurane using large-animal anesthesia techniques (Heath et al. 1996) and standard monitoring procedures to reduce the risk of anesthetic death (i.e., monitor heart rate, ventilation and blood oxygen saturation). Juveniles will be captured in the water by ADFG divers using a lasso and then anesthetized with isoflurane. No juveniles will be captured on land. We will use persons from ADFG and NMFS that have experience with this underwater capture technique. If an animal appears excessively distressed, it will be released.

While an animal is anesthetized, the following tissue samples will be taken or procedures conducted one time to assess health and population status: 1) blood from the caudal gluteal vein for standard hematology and blood chemistry (up to 20 ml), 2) skin sample from the fore flipper using a flipper punch for genetic analysis; blubber (up to 0.5 g) for fatty acid analysis and toxicological analysis, 3) rectal, vaginal, ocular and dermal lesion swabs for standard pathology, 4) hot branding [standard technique used by NMFS and ADFG] for long-term identification. SSL will be weighed using a specially designed tripod, sling and electronic digital scale that is accurate to $\pm$ 0.5 kg. After cleaning the fur in the mid-dorsal area of the sea lion with, a remote release pack with the video/data recorder (see pp 10-14 of the attached proposal for Project 1 for a detailed description of the instrumentation) will be glued with epoxy or neoprene rubber cement to the fur along the dorsal midline above the shoulders. A smaller remote release system will be glued to the top of the animal's head. The combination camera head/GPS housing rests in the second release pack mounted on the head. The dual release system can be remotely triggered to allow the video system/data recorder to fall off. The low-profile, remote release pack eventually falls off when the sea lion molts three to six months later. We will use satellite transmitters (Wildlife Computers, 200 g) and VHF radio transmitters (165 MHz; 92 g; Advanced Telemetry Systems) to track and relocate instrumented animals. These transmitters will be glued with epoxy or neoprene rubber cement to the sea lion's fur. The video system will remain on the animal for up to two weeks before triggering the release. The transmitters will fall off when the animal molts three to six months later.

**C4. Removing a Marine Mammal from the Wild:** No animals will be removed from the wild.

**C5. Taking of Marine Mammal Parts of Specimen Samples:** We will take blood samples (20 ml), tissue samples (skin sample with a flipper punch and a 0.5 g blubber biopsy) and rectal, vaginal, ocular and dermal lesion swabs from each animal one time (see Table 1). We do not plan to kill or euthanize any animals. However, if an animal dies accidentally during sedation, we will take samples of all organs and tissues back to Texas A&M University. These samples will be used on our on going studies of marine mammal morphological and metabolic adaptations for diving and hypoxia.

**C6. Import/Export of Marine Mammals/Marine Mammal Parts:** We will not be importing or exporting marine mammals or their parts.

**C7. Research on Captive Animals:** No research will be conducted on captive animals.

**C8. Background and Review of Research:** see pp 2-3 of the attached research proposal for Project 1 and pp 1-2 for Project 2.

**C.9 Lethal Take.** No intentional lethal take is proposed. However, unintentional mortalities related to the proposed research are possible and we request authorization for 13 accidental mortalities per year and a total of 65 for the five year period of this permit.

**C.10 Research on Endangered Species**: Our research will complement already funded investigations of diving behavior and provide a better understanding of the foraging ecology and hunting behavior of juvenile and adult SSL. These topics have been identified as research objectives in the recovery plan. Due to the nature of these studies, they cannot be performed on other species. A surrogate species would provide little direct information on the at-sea behavior and habitat use of SSL. See pp 2-10 of the attached research proposal for Project 1 and pp 1-3 for Project 2 for a justification of the age classes to be studied.

## IV.D. EFFECTS OF THE PROPOSED ACTIVITIES

**D1. Effects on Individual Animals:** Effects of the proposed activities will be limited to short term (ca. three hours) behavioral (resting, nursing, socializing) disruption of individuals during capture. During capture operations, some animals may leave the rookery and enter the water. Based on our previous experience, pup injury or abandonment is rare, but could occur while we are capturing an animal on a rookery. When capturing subadults using the underwater lasso technique, an animal may drown, although this is has not occurred to date. We will work with persons from ADFG and NMFS that have experience with this underwater capture technique. During darting and gas anesthesia, we will use standard monitoring procedures to reduce the risk of anesthetic death (i.e., monitor heart rate, ventilation and blood oxygen saturation). Sterile techniques will be used when taking blood and tissue samples to reduce the risk of infection. Since these procedures will be performed while the animal is anesthetized, pain and stress will be minimized.

The video system/data recorder is neutrally buoyant, but it will increase hydrodynamic drag. However, the instruments will increase the animal's maximum cross sectional area by less than 5%, so drag augmentation will be relatively small. The satellite and VHF radio tags are very small (< 200 g) compared to the size of SSL and will contribute negligibly to the animal's body mass and drag

**D2. Effects of Incidental Harassment:** Incidental harassment of other SSL on rookeries and haulouts during capture operations will be short duration (ca. three hours). We will make every attempt to minimize disruption of rookeries during capture by working along the edge of the rookeries.

**D3. Effects on Stocks:** No long-term, adverse effects are anticipated on SSL stocks with regards to their reproductive rates or continued survival in the wild. Our research will contribute to our understanding of SSL biology and may, therefore, contribute toward management polices that will promote the recovery of the species.

**D.4. Stress, pain and suffering**: We have obtained an Animal Use Permit from Texas A&M University. The AUP review committee deemed our procedures humane and appropriate to the research objectives. There are no feasible alternative methods for obtaining the data or information being sought from free-ranging SSL. Procedures that

cause pain (e.g., blood and tissue sampling, hot branding, flipper tagging) will be conducted under gas anesthesia.

**D.5 Measures to minimize disturbance**: Darting SSL on the rookery will cause disturbance (i.e., some animals will move away or enter the water). We will minimize disturbance by working along the edges of the rookery and not entering areas with high densities of animals. However, we cannot completely avoid disturbing some animals, and we have requested that up to 400 animals be disturbed each year while we are capturing animals and attaching instruments.

**D.6. NEPA considerations**

a) Does the research involve new, innovative, controversial or experimental equipment or techniques?

Other investigators have successively used the capture, anesthesia and tagging techniques that will be used in this research. The only innovative aspect to our research is the use of a video/data recorder. However, the method of attachment is similar to other recorders and telemeters.

b) Are the research techniques are likely to be adopted by other researchers?

Most of the research techniques we will use are already in use by other investigators, except for the video/data recorder, which was developed in our lab. However, we anticipate that other researchers will eventually use the video/data recorder.

c) Is the location in which the research will be conducted is of special importance to other marine mammals? No

d) Do the proposed activities involve unique or unknown risks or whether the likely effects are highly uncertain? No

e) Will any aspect of the research possibly affect the public health or safety of humans? No

f) Will the activity have a significant cumulative effect, considering existing and potential activities?

Probably not. However, we are unaware of the full scope of other research projects on SSL currently being conducted or under consideration.

g) Will the activity cause loss or destruction of significant scientific, cultural or historic resources? No

h) Will there be an adverse effect on endangered or threatened populations or stocks or their habitat? No

i) Is the activity in violation of a Federal, State or local law for environmental protection? No

## IV.E. PUBLICATION OF RESULTS

Results from the proposed research will be published in peer-reviewed journals (e.g., Marine Biology, Functional Ecology) when the projects are completed in 2005.

## IV.F. PROPOSAL AND PREVIOUS AND OTHER PERMITS

**F1. Formal research proposal:** see attached research proposals for Projects 1 and 2.

**F2. Sponsors and Cooperating Institutions:** this research is supported by grants awarded by the National Marine Fisheries Service under the Steller Sea Lion Research Initiative (Project 1. Foraging Ecology and Hunting Behavior of Adult and Juvenile Steller Sea Lions) and the Alaska SeaLife Center (Project 2. Sea Lion Critical Habitat Assessment). Donald Calkins of the ASLC is the Co-investigator for the latter project. In addition, the NMFS and the ASLC will provide ship logistical support. Details of the financial awards may be obtained from the Texas A&M University at Galveston Research Office (409-740-4941).

**F3. Previous Permits:** Our current five-year permit (No. 821-1588-00) expires in September 2005. Annual reports have been filed on permit activities.

**F4. Other Permits:** N/A

## V. SPECIAL CONSIDERATIONS FOR APPLICANTS WORKING ABROAD

N/A

## VI. CERTIFICATION AND SIGNATURE

I hereby certify that the foregoing information is complete, true, and correct to the best of my knowledge and belief. I understand that this information is submitted for the purposes of obtaining a permit under one or more of the following statutes and the regulations promulgated thereunder, as indicated in Section I of this application:

The Endangered Species Act of 1973 (16 U.S.C. 1531-1543) and regulations (50 CFR Parts 217-222);

The Marine Mammal Protection Act of 1972 (16 U.S.C. 1361-1407) and regulations (50 CFR Part 216); and/or

The Fur Seal Act of 1966 (16 U.S.C. 1151-1175) and regulations (50 CFR Part 215).

I also understand that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or to penalties provided under the Endangered Species Act of 1973, the Marine Mammal Protection Act of 1972, or the Fur Seal Act of 1966, whichever are applicable.

_____ _____

Signature of applicant Date

Randall W. Davis
Professor, Department of Marine Biology

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